

# इंटरनेट

# मानक

## Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 7896 (2001): Data for Outside Design Conditions for Air Conditioning for Indian Cities [MED 3: Refrigeration and Air Conditioning]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



BLANK PAGE



IS 7896 : 2001

भारतीय मानक  
भारतीय शहरों के लिए वातानुकूलन के लिए आंकड़ों  
के वाह्य डिजाइन की स्थितियां  
( पहला पुनरीक्षण )

*Indian Standard*  
DATA FOR OUTSIDE DESIGN CONDITIONS FOR  
AIR CONDITIONING FOR INDIAN CITIES  
( *First Revision* )

ICS 91.140.30

© BIS 2001

**BUREAU OF INDIAN STANDARDS**  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

November 2001

Price Group 2

## FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Refrigeration and Air Conditioning Sectional Committee had been approved by the Mechanical Engineering Division Council.

This Indian Standard was published in 1975 with a view to make the data available for outside design conditions for air conditioning for summer months. In this standard the outside design conditions were based on the percentage occurrence, that is, the total number of hours when a particular temperature has been equalled or exceeded during the three summer months in 10 years. The design conditions for 16 important cities in the country based on 10 percent, 5 percent, 2.5 percent and 1 percent occurrence of maximum temperature were established.

With the major spurt in the construction of multi-storeyed buildings in the metropolitan cities, the installations of central air conditioning systems have become an absolute requisite. The outside design conditions which form the basis of calculating the capacity of the plant that will be necessary for a building in a particular location in the country, becomes an effective tool for the guidance of the air conditioning industry.

The wide divergence of climatic conditions in the different parts of the country indicates that the same conditions may not be suitable for the design of air conditioning installations in different cities. The necessity, therefore, of laying down the realistic design conditions to suit the different locations has been realized.

Erstwhile ISI now BIS took up the work of establishing outside design conditions for different cities as a collaborative project with the Central Building Research Institute, Roorkee, and India Meteorological Department, New Delhi. Based on the hourly record, for the various cities, made available by India Meteorological Department, regarding the simultaneous dry and wet bulb temperatures for the months of April, May and June for 10 consecutive years, the Central Building Research Institute had done the frequency analysis and computed the data for outside design temperatures to be used as the basis of air conditioning design.

Since this standard provided outside design conditions for summer months only and that too of 16 stations only, there was need for updating the standard to cover design conditions for summer, monsoon and winter and to furnish data for more stations so that these could become useful for the engineers, professionals and organizations engaged in air conditioning, heating, ventilation, energy analysis and conservation aspects of buildings. Hence the first revision of this standard has been undertaken.

Ministry of Non-Conventional Energy Sources sponsored the project to compile the data for 58 cities. ASHRAE and ISHRAE 'Indian Society of Heating, Refrigerating and Air Conditioning Engineers' actively associated in the project with assistance from Tata Energy Research Institute (TERI). The list of stations was finalized in consultation with Indian Meteorological Department (IMD), Govt. of India. Two important criteria for selecting the sites for collection of weather data were the importance of the site/stations from the point of view of high economic or construction activity, and the availability of weather data for those stations. Initially the project team, decided to procure synoptic hour data from IMD for 94 stations. The data was not of acceptable quality for a number of stations and for this reason, only 58 stations were finally selected for the development of ambient design conditions.

Composition of the Committee responsible for the formulation of this standard is given in Annex A.

In this revision the design conditions cover 58 stations of the country and the data is furnished in International format as adopted by 1997 ASHRAE Handbook—Fundamental (American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc).

**AMENDMENT NO. 1 MARCH 2003  
TO  
IS 7896 : 2001 DATA FOR OUTSIDE DESIGN  
CONDITIONS FOR AIR CONDITIONING  
FOR INDIAN CITIES**

*( First Revision )*

*( Page 2, Table 1, third column heading and its sub-columns ) — Substitute 'Cooling WB/MCDB' for 'Cooling DB/MCDB' and 'WB' in place of 'DB' respectively*

*( Page 2, Table 1, fourth column heading ) — Substitute 'Heating DB/MCWB' for 'Heating DB/MCDB'*

*( Page 2, Table 1, Data against 'Station Name' Chennai in the fourth column 'Heating DB/MCWB' ) — Substitute '18.7' for '20.2' under 99.6% MCWB and '20.2' for '18.7' under 99.0% DB.*

*( Page 2, Table 1 Data against 'Station Name' Nagpur in the third column 'Cooling WB/MCDB' ) — Substitute '27.3' for '21.2' under 0.4% WB*

( ME 03 )

*Indian Standard*

# DATA FOR OUTSIDE DESIGN CONDITIONS FOR AIR CONDITIONING FOR INDIAN CITIES ( First Revision )

**1 SCOPE**

This standard covers the outside design conditions for air conditioning and heating on internationally accepted format, explained hereunder:

- a) Dry bulb (DB) temperature corresponding to 0.4 percent, 1.0 percent and 2.0 percent annual cumulative frequency of occurrence and the mean coincidental wet bulb temperature (MCWB) (Summer - Cooling DB/MCWB)
- b) Wet bulb (WB) temperature corresponding to 0.4 percent, 1.0 percent and 2.0 percent annual cumulative frequency of occurrence and the mean coincidental dry bulb temperature (Monsoon - Cooling WB/MCDB)
- c) Dry bulb (DB) temperature corresponding to 99.6 percent and 99.0 percent annual cumulative frequency of occurrence and the mean coincidental wet bulb temperature (Winter - Heating DB/MCWB)

**2 OUTSIDE DESIGN CONDITIONS**

2.1 The outside design conditions for 58 stations is given in Table 1

**2.2 Basis of Arriving at Outside Design Conditions**

2.2.1 The cumulative frequency distribution curves for dry bulb temperature and wet bulb temperature were

obtained using the entire sequence of these parameters for all the available years for each station, after calculating the frequencies of temperature in a bin size of 0.1°C. The design temperatures had been derived directly from the cumulative frequency curves.

2.2.2 Values of ambient dry bulb and wet bulb temperatures to the various annual percentiles represent the value that is exceeded on average by the indicated percentage of the total number of hours. The 0.4%, 1.0%, 2.0% values are exceeded on average 35, 88 and 175 hours in a year. The 99.0% and 99.6% values are defined in the same way but are usually viewed as the values for which the corresponding weather elements are less than the design conditions 88 and 35 hours, respectively.

2.2.3 Mean coincidental values are the average of the indicated weather element occurring concurrently with the corresponding design value.

2.2.4 After the calculation of design dry bulb temperatures, the computer located the values of corresponding wet bulb temperature from the database for the particular station and calculated the average of these values which was then called mean of coincidental wet bulb temperature.

2.2.5 In the same way design wet bulb temperature and coincidental dry bulb temperature was evaluated.

NOTE — In case monthly mean, maximum and range of dry bulb temperatures for these stations are required the booklet entitled 'Weather Data and Design Conditions for India' may be procured from ISHRAE.

**Table 1 Data for Outside Design Conditions for Indian Cities**  
(Clause 2.1)

Station Name	Cooling DB/MCWB						Cooling DB/MCDB						Heating DB/MCDB			
	0.4%		1.0%		2.0%		0.4%		1.0%		2.0%		99.6%		99.0%	
	DB	MCWB	DB	MCWB	DB	MCWB	DB	MCDB	DB	MCDB	DB	MCDB	DB	MCWB	DB	MCWB
Ahmedabad	42.3	24.1	41.2	23.5	40.0	24.3	28.7	34.3	28.2	33.6	27.8	33.1	11.5	9.0	12.9	9.8
Akola	43.4	24.0	42.2	23.3	41.0	23.6	27.6	37.8	26.7	34.4	26.1	33.5	12.7	10.3	13.9	10.6
Allahabad	43.7	23.4	42.2	23.5	40.8	22.7	28.8	33.0	28.4	32.8	28.0	32.6	7.9	7.0	9.1	8.3
Amritsar	41.6	23.2	40.3	24.6	38.9	24.4	29.3	34.8	28.8	34.8	28.4	33.4	2.7	2.3	4.0	3.5
Aurangabad	40.3	22.1	39.3	22.9	38.3	21.3	26.3	36.2	25.3	33.1	24.7	31.4	10.6	8.2	12.0	9.1
Bangalore	34.7	19.6	34.0	19.6	33.1	19.2	23.5	28.9	22.9	28.2	22.5	27.7	14.9	13.0	15.7	13.8
Barmer	43.1	24.2	42.0	23.6	41.0	23.3	28.5	37.9	27.8	35.3	27.2	33.3	9.5	5.1	10.7	5.5
Belgaum	36.5	19.4	35.7	19.6	34.7	19.2	24.3	29.2	23.8	29.5	23.4	28.2	13.2	11.3	14.3	12.2
Bhagalpur	42.4	26.8	40.7	27.4	38.9	25.6	30.0	37.1	29.6	36.4	29.2	35.2	11.4	10.3	12.6	11.4
Bhopal	41.7	22.0	40.5	21.7	39.3	21.3	26.0	31.0	25.6	30.3	25.2	29.9	9.8	6.8	11.0	8.0
Bhubneshwar	38.9	25.5	37.6	26.6	36.3	26.3	29.4	35.2	28.9	33.3	28.5	32.7	14.4	13.1	15.4	14.0
Bikaner	44.8	22.4	43.4	22.4	42.0	23.1	28.5	34.6	27.9	33.1	27.3	34.7	3.8	2.2	5.3	3.1
Kolkata	37.2	25.4	36.2	26.1	35.2	26.5	29.5	34.3	29.0	33.4	28.6	32.7	10.2	10.9	13.1	11.9
Chennai	38.4	26.2	37.3	26.7	36.3	26.4	29.1	33.8	28.6	33.2	28.1	31.9	19.5	20.2	18.7	19.3
Chitradrug	36.6	18.8	35.8	19.0	35.0	19.6	23.9	28.9	23.5	28.2	23.2	28.5	15.4	12.5	16.4	13.3
Dehra Dun	37.8	23.5	36.3	23.9	34.8	22.8	27.0	31.3	26.5	30.1	26.0	29.8	5.9	5.0	6.8	5.8
Dibrugarh	34.0	27.4	33.2	26.8	32.3	26.7	28.3	32.6	27.8	31.8	27.4	31.3	7.5	7.2	8.7	8.4
Gorakhpur	41.4	26.2	40.3	26.0	39.1	26.4	29.7	35.2	29.7	35.5	29.4	34.7	7.9	7.5	9.0	8.4
Guwahati	34.4	26.9	33.4	27.3	32.7	26.8	28.8	32.4	28.3	31.8	27.4	31.5	10.2	9.8	11.3	10.8
Gwalior	43.9	23.0	42.5	22.9	41.3	23.5	27.9	32.9	27.6	32.4	27.3	32.7	4.9	3.8	6.4	5.3
Hissar	44.7	26.5	43.3	25.8	41.7	27.9	30.1	40.2	29.9	39.0	29.4	36.8	5.0	4.2	6.1	5.2
Hyderabad	40.4	22.5	39.2	22.5	38.2	22.4	25.6	33.7	25.2	32.4	24.8	32.0	14.4	12.4	15.5	12.9
Imphal	31.1	23.3	30.2	23.5	29.6	22.9	25.0	29.5	24.6	28.6	24.3	28.3	3.9	3.6	5.0	4.6
Indore	41.1	20.7	40.4	20.6	38.9	21.0	25.7	31.0	25.2	30.0	24.8	29.8	8.2	5.0	9.7	6.5
Jabalpur	42.6	22.7	41.2	23.2	39.8	22.5	26.8	31.8	26.4	32.0	26.0	31.2	7.8	6.7	9.3	7.6
Jagdelpur	39.4	22.3	38.6	22.5	37.4	22.4	26.4	32.4	25.9	31.8	25.4	30.7	8.9	7.9	10.1	8.7
Jaipur	42.8	22.5	41.4	22.6	39.4	22.6	27.4	33.1	27.0	32.1	26.6	31.7	6.4	4.5	8.0	5.8
Jaisalmer	43.7	23.7	42.5	23.1	41.4	23.5	27.7	34.8	27.3	34.5	26.9	34.4	5.0	2.5	6.5	3.7
Jamnagar	37.1	24.4	36.1	25.6	35.3	25.1	29.2	33.0	28.4	32.5	27.9	32.0	10.0	8.6	11.7	10.5
Jodhpur	42.0	23.2	40.8	23.0	39.6	22.7	28.0	35.4	27.4	33.7	26.9	33.8	7.5	4.3	8.7	5.4
Jorhat	34.4	28.2	33.6	27.7	32.9	27.3	28.7	32.7	28.3	32.1	28.0	31.8	9.6	9.0	10.6	10.1
Kota	43.5	23.0	42.4	22.6	41.2	22.6	27.3	35.2	26.8	33.0	26.5	31.8	9.9	6.7	10.8	7.6
Kumool	41.6	23.2	40.3	24.6	38.9	24.4	29.3	34.8	28.8	34.8	28.4	33.4	2.7	2.3	4.0	3.5
Lucknow	42.0	24.2	40.8	24.8	39.3	24.5	28.8	33.3	28.4	32.4	28.0	32.2	7.5	6.8	8.4	7.7
Mangalore	33.9	24.4	33.9	24.0	33.4	24.2	27.1	31.0	26.7	31.0	26.4	30.7	19.7	17.0	20.5	18.1
Mumbai	35.3	22.8	34.3	23.3	33.5	24.0	27.9	31.8	27.5	31.3	27.2	31.1	16.5	13.9	17.8	14.8
Nagpur	43.8	23.6	42.6	23.9	41.4	23.6	21.2	31.2	26.6	33.2	26.2	31.9	11.5	9.4	12.8	10.2
Nellore	40.4	27.8	39.0	28.1	37.8	27.2	30.0	37.1	29.4	35.4	28.8	34.0	19.4	18.3	20.2	19.3
New Delhi	41.8	23.6	40.6	23.8	39.4	23.5	28.4	33.3	28.0	33.3	27.6	32.7	6.0	5.2	7.1	6.3
Panaji	34.0	24.8	33.5	25.2	33.0	25.2	27.7	32.3	27.4	31.5	27.0	30.9	19.6	17.8	20.3	18.7
Patna	40.7	23.4	39.5	23.7	38.0	24.7	29.0	33.9	28.6	33.1	28.3	32.6	8.0	7.6	9.2	8.6
Pune	38.4	20.5	37.4	20.4	36.3	20.6	24.8	30.9	24.4	30.6	24.0	29.6	9.2	8.0	10.3	9.2
Raipur	43.6	23.3	42.2	23.3	40.8	23.0	27.1	31.8	26.8	32.0	26.5	31.2	11.3	9.9	12.6	10.4
Rajkot	40.8	23.1	39.9	23.8	38.9	23.4	28.1	33.9	27.6	33.3	27.1	32.3	10.9	6.5	12.2	7.7
Ramagundam	43.4	25.6	42.2	25.1	40.7	25.8	28.3	37.3	27.9	35.6	27.4	34.4	12.5	11.2	13.7	12.5
Ranchi	38.9	22.1	37.7	21.8	36.4	21.5	26.2	31.7	25.6	30.4	25.2	29.2	9.1	7.2	10.4	8.3
Ratnagiri	34.1	22.4	33.4	23.2	32.8	23.6	27.6	31.1	27.3	30.8	27.0	30.2	18.3	14.9	19.2	16.5
Raxaul	38.6	23.1	36.9	24.5	35.5	24.6	28.9	33.0	28.4	32.0	28.1	31.8	7.5	7.3	8.5	8.2
Saharanpur	41.3	23.8	39.6	24.6	38.1	24.0	28.5	33.6	28.1	32.9	27.8	32.5	1.7	1.5	3.0	2.7
Shillong	24.2	19.7	23.5	19.4	22.8	18.9	20.7	23.3	20.3	22.7	19.9	22.2	-1.0	-1.1	0.1	-0.5
Sholapur	41.1	21.6	40.1	21.6	39.1	21.2	26.6	32.6	25.8	32.1	25.1	31.5	16.3	12.4	17.2	12.5
Sundarnagar	36.1	19.1	34.6	19.9	33.1	19.4	25.2	30.1	24.8	29.2	24.4	28	1.8	1.3	2.8	2.2
Surat	38.4	22.7	36.9	23.9	35.7	23.4	28.3	32.4	27.9	31.7	27.6	31.4	14.8	11.6	16.2	12.5
Tezpur	34.2	27.4	33.3	26.5	32.5	27.1	28.9	32.8	28.4	31.8	28.0	31.4	10.5	10.0	11.4	10.9
Tiruchirappalli	39.6	24.6	38.7	25.1	37.8	24.9	27.7	34.5	27.2	33.7	26.9	33.3	19.3	18.2	20.1	18.7
Thiruvananthapuram	33.9	26.0	33.4	26.1	32.9	25.9	27.7	32.4	27.4	31.9	27.0	31.0	21.6	20.1	22.2	20.8
Veraval	35.2	23.9	33.8	23.5	32.8	26.6	29.1	32.3	28.7	31.6	28.4	31.1	14.3	10.1	15.6	11.3
Visakhapatnam	36.4	26.5	35.6	27.3	35.0	27.1	29.2	33.8	28.8	33.0	28.4	32.5	15.4	14.9	16.8	16.2

**Abbreviations**

DBT Dry bulb temperature

WBT Wet bulb temperature

MCDB Mean coincidental dry bulb temperature

MCWB Mean coincidental wet bulb temperature

NOTE — Selection of values from a particular column depends upon the type of application. HVAC system designer may accordingly use the values given above.



# ANNEX A

## (Foreword)

### COMMITTEE COMPOSITION

#### Refrigeration and Air Conditioning Sectional Committee, ME 03

<i>Organization</i>	<i>Representative(s)</i>
Indian Institute of Technology, New Delhi	PROF R. S. AGARWAL ( <i>Chairman</i> )
All India Air Conditioning & Refrigeration Association, New Delhi	SHRI KAMAL SAHDEV
	SHRI A. P. KHURANA ( <i>Alternate</i> )
ASHRAE India Chapter, Gurgaon	SHRI P. K. CHOWDHURY
	SHRI ASHISH REKHEJA ( <i>Alternate</i> )
Blue Star Limited, Thane	SHRI D. RAVINDRA
	SHRI N. SIVASANKARAN ( <i>Alternate</i> )
Central Public Works Department, New Delhi	CHIEF ENGINEER (E)
	SUPERINTENDENT ENGINEER ( <i>Alternate</i> )
Confederation of India Industry, New Delhi	SHRI S. S. GOPALKRISHNAN
Directorate General of Supplies & Disposals, New Delhi	SHRI J. K. KHANNA
	SHRI R. KARUPPIAH ( <i>Alternate</i> )
Directorate of Quality Assurance, Pune	COL M. S. PARTHASARATHY
	LT-COL B. T. JADE ( <i>Alternate</i> )
Energy Management Centre, New Delhi	SHRI J. VASUDEVAN
	SHRI SATISH SABHARWAL ( <i>Alternate</i> )
Fedders Lloyd Corporation Ltd, New Delhi	SHRI H. J. KEWALRAMANI
	SHRI UMAKANT V. H. ( <i>Alternate</i> )
Frac Power Motors, New Delhi	SHRI V. D. TREHAN
Godrej Appliances Ltd, Mumbai	SHRI B. J. WADIA
	SHRI N. T. DESAI ( <i>Alternate</i> )
Infos Industries Ltd, New Delhi	SHRI S. S. MALHOTRA
	SHRI D. K. JAIN ( <i>Alternate</i> )
Indian Society of Heating, Refrigerating and Air conditioning Engineers, New Delhi	PRESIDENT
Kirloskar Copeland Ltd, Pune	SHRI V. G. SARDESAI
	SHRI N. M. INGLE ( <i>Alternate</i> )
Kirloskar Pneumatic Co Ltd, Pune	SHRI V. D. MANE
	SHRI ADITYA KOWSHIK ( <i>Alternate</i> )
National Dairy Development Board, Anand	SHRI V. D. JOSHI
	SHRI T. N. JAYARAMAN ( <i>Alternate</i> )
National Thermal Power Corporation Ltd, New Delhi	SHRI S. ANAND
	SHRI T. PAL ( <i>Alternate</i> )
Tecumseh Products India Ltd, Hyderabad	DR VENKATESWARLU
	SHRI V. RAGHAVENDRA RAO ( <i>Alternate</i> )
Annapurna Electronics & Services Ltd, Hyderabad	SHRI G. K. PRASAD
Tata Energy Research Institute, New Delhi	SHRI PANKAJ BHATTIA
	DR AJAY MATHUR ( <i>Alternate</i> )
Videocon Appliances Ltd, Aurangabad	SHRI M. S. DHABER
	SHRI S. SHANKARNARAYANAN ( <i>Alternate</i> )
Volga Airtechnics Ltd, Ahmedabad	SHRI A. K. MEHTA
Voltas Limited, Mumbai	SHRI S. R. SRINIVASAN
	SHRI M. M. ROY ( <i>Alternate</i> )
Voltas Ltd (White Goods), Hyderabad	SHRI S. JAMES
	SHRI S. BHUJANGA RAO ( <i>Alternate</i> )
Whirlpool of India Ltd, Ranjangaon, Pune	SHRI S. M. SASTRY
BIS Directorate General	SHRI M. L. CHOPIRA, Director & Head (MED)
	[Representing Director General ( <i>Ex-officio</i> )]

*Member-Secretary*  
SHRI P. VENKATESWARA RAO  
Joint Director (MED), BIS

(Continued on page 4)

## IS 7896 : 2001

(Continued from page 3)

### Air Conditioning Panel, ME 3/P-2

<i>Organization</i>	<i>Representative(s)</i>
Voltas Limited, Mumbai	SHRI L. C. GUPTA ( <i>Convener</i> ) SHRI R. H. JAGIDAR ( <i>Alternate</i> )
All India Air Conditioning & Refrigeration Association, New Delhi	SHRI R. K. MALHOTRA SHRI A. P. KHURANA ( <i>Alternate</i> )
Amtrax Appliances Ltd, Dist Mehsana	SHRI P. R. SUBRAMANIAM
Blue Star Limited, Thane	SHRI D. RAVINDRA SHRI H. SIVASANKARAN ( <i>Alternate</i> )
Carrier Aircon Ltd, Gurgaon	SHRI S. S. GOPALAKRISHNAN SHRI K. K. SHARMA ( <i>Alternate</i> )
Directorate General of Supplies & Disposals, New Delhi	SHRI G. C. CHADA SHRI V. K. SRIDHAR ( <i>Alternate</i> )
Fedders Lloyd Corporation Ltd, New Delhi	SHRI H. J. KEWAL RAMANI SHRI V. H. UMAKANT ( <i>Alternate</i> )
Kirloskar Copeland Limited, Pune	SHRI V. G. SARDESAI SHRI N. M. INGLE ( <i>Alternate</i> )
Kirloskar Pneumatics Co Ltd, Pune	SHRI V. D. MANI SHRI A. S. KULKARNI ( <i>Alternate</i> )
Tecumseh Products India Ltd, Hyderabad	DR. VENKATESWARLU SHRI V. RAGHAVENDRA RAO ( <i>Alternate</i> )
Vedionex Appliances Ltd, Aurangabad	SHRI AJAY BHAVSAGAR
Weathermakers (Airconditioning) Pvt Ltd, Kolkata	SHRI S. K. DAS
Godrej Appliances Ltd, Mumbai	SHRI D. D. RAJADHYAKSHI SHRI AMITAR SAMANTA ( <i>Alternate</i> )

## Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country

## Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS

## Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically, a standard along with amendments is reaffirmed when such review indicates that no changes are needed, if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards Monthly Additions'

This Indian Standard has been developed from Doc No ME 03 (588).

### Amendments Issued Since Publication

Amend No	Date of Issue	Text Affected

### BUREAU OF INDIAN STANDARDS

#### Headquarters .

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002  
Telephones 323 01 31, 323 33 75, 323 94 02

Telegrams . Manaksanstha  
(Common to all offices)

#### Regional Offices

		Telephone
Central	Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110 002	{ 323 76 17 323 38 41
Eastern	1/14 C I T Scheme VII M, V I P Road, Kankurgachi KOLKATA 700 054	{ 337 84 99, 337 85 61 337 86 26, 337 91 20
Northern	SCO 335-336, Sector 34-A, CHANDIGARH 160 022	{ 60 58 43 60 20 25
Southern	C I T Campus, IV Cross Road, CHENNAI 600 113	{ 254 12 16, 254 14 42 254 25 19, 254 13 15
Western	Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400 093	{ 832 92 95, 832 78 58 832 78 91, 832 78 92

Branches . AHMEDABAD BANGALORE BHOPAL BHUBANESHWAR. COIMBATORE.  
FARIDABAD GHAZIABAD GUWAHATI HYDERABAD. JAIPUR KANPUR.  
LUCKNOW NAGPUR NALAGARH. PATNA PUNE RAJKOT THIRUVANANTHAPURAM.